

The effects of Equal Weight Bearing Sit-to-Stand Exercise Program on Balance in Stroke Patients: A Randomized Clinical Trial

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ABSTRACT

Objective: To determine the effectiveness of routine physical therapy with and without equal weight bearing sit to stand exercise program on balance in stroke patients.

Study Design: Randomized Clinical trial (IRCT-50122)

Place and Duration of Study: Physiotherapy department of University of Lahore Teaching Hospital, Omer Medical Centre, Lahore and Yaseen Medical Centre, Lahore Pakistan from Nov 2019 to Jun 2020.

Methodology: The 24 participants with sub-acute stroke aged 40-60 years were divided randomly using lottery method, into two equal groups of 12 each. A random number table was generated using computer. All random numbers were kept in a sealed envelope. For each patient a sealed envelope was opened and according to mentioned number, group was allocated. The assessment was done before treatment, at 4th week and after 8th week of intervention. Control Group received the 3 sessions per week of routine physical therapy treatment. Experimental Group received 3 sessions per week of routine physical therapy with equal weight bearing sit-to-stand exercise.

Results: Control Group consist of 12 stroke patients, out of which had 5(41.7%) hemorrhagic while 7(58.3%) had ischemic stroke. In Experimental Group, there were 2(16.7%) hemorrhagic while 10(83.3%) stroke patients. According to p -value=0.001 for factor significant improvement was seen in berg balance scale total score from baseline till 2nd follow up.

Conclusion: This study concluded that equal weight bearing sit to stand exercise program with routine physiotherapy was an effective treatment to improve balance in sub-acute stroke patients as compared to the only routine physiotherapy.

Keywords: Balance, Cerebrovascular accidents, Lower extremity, Sit to stand, Stroke.

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INTRODUCTION

Stroke is the abrupt loss of neurological capacity, brought about by an interference of blood stream to the cerebrum.¹ Clinically, a variety of central deficiencies are conceivable, incorporating changes in the degree of awareness and hindrances of sensory, cognitive, motor, perceptual, and language capacities.² Motor Deficits are described by loss of motion (hemiplegic) or partial loss of motion (hemiparesis), typically on the opposite side of the body having lesion.³ The stroke events at that point causes various restrictions in functions which incorporate muscle power reduce, pain, spasticity, disturbance in cognition and poor Balance.⁴

After stroke, patients have less balance capacity, including asymmetry distribution of weight-bearing, postural steadiness and a decrease in their breaking points of soundness.⁵ Sit-to-stand(STS) is seen as a crucial element for every day exercises and post-stroke

people don't effectively recoup this capacity to rise securely from a seat.⁶ Stroke patients who fall put a very less load on their paretic limb than the non-fallers during sit-to stand transition. To upgrade body balance in respect with performing sit-to-stand, sound-related input or visual feedback was utilized, or strategy for adjusting or rectifying foot position was utilized.⁷

A systemic review conducted by Chaovalit in 2018 presumed that STS training may be a helpful rehabilitation program when patients have constrained STS work and the point of rehabilitation is the performance improvement.⁸ A writing survey led in 2015 by Boukadida concluded that Some restoration interventions might be compelling in improving STS length, weight bearing symmetry and the capacity to stand freely with rehashed practice of STS assignments.⁹ Jansen directed a review in 2002 drawn a conclusion that capacity to do a STS development, as per the research assessed, is firmly affected by the stature or height of the seat or chair, utilization of armrests, and foot position.¹⁰

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Few studies have been found on efficacy of STS training on balance in patients with stroke. There is a controversy as some studies stated that STS training might not be a useful rehabilitation program when the goal is to improve functions other than STS training i.e. balance. The aim of this study is to determine the effectiveness of routine physical therapy with and without equal weight bearing exercise program on balance and functional outcome in stroke patients.

METHODOLOGY

The randomized clinical trial (IRCT-50122) was conducted on sub-acute stroke patients visiting physiotherapy department in different hospitals of Lahore from November 2019 to June 2020. The data was collected from UOL Teaching Hospital, Omer Medical Centre Lahore and Yaseen Medical Centre, Lahore Pakistan. The rules and regulations set by the ethical committee of university of Lahore was followed while conducting the research and the rights of the research participants. Respect for the dignity of research participants was prioritised. Full consent was obtained from the participants prior to the study.

Inclusion Criteria: Clinically diagnosed sub-acute stroke patients (stroke onset between 2 weeks to 6 months), aged 40-60 years, both hemorrhagic or ischemic types and able to follow a one-stage command, were included.

Exclusion Criteria: The patients with musculoskeletal disorder, unstable angina, coexisting physical impairments, substantial loss of joint range due to arthritis, no previous history of neurological disease other than stroke and inability to provide informed consent were excluded.

The 24 participants fulfilling the eligibility criteria were divided randomly using lottery method, into two equal Groups of 12 each. A random number table was generated using computer. All random numbers were kept in a sealed envelope. For each patient a sealed envelope was opened and according to mentioned number, Group was allocated.

The sample size was calculated by the following formula keeping the power of study equal to 80% and level of significance equal to 95%. The sample size should be 14 in each Group considering 20% dropout rate. There was a dropout of 2 patients in both Groups due to unwillingness and distance.

$$n = \frac{(Z_{1-\beta} + Z_{1-\alpha/2})^2 (\delta_1^2 + \delta_2^2)}{(\mu_1 - \mu_2)^2}$$

Control Group received the 3 sessions per week routine physical therapy treatment that includes TENS, Muscles Stretching, Strengthening and range of Motion Exercises for 45-60 minutes. In one session, TENS and Hot pack was given for 15 minutes. Static stretching of affected muscles was performed according to the participant requirement. The muscle strengthening exercises included loading of affected leg with unaffected leg placed on a wooden block, stepping up exercise with the affected leg (stepping up a wooden block with the affected leg), stepping down with the affected leg, heels lift. Fifteen repetitions of each exercise were given with a resting period of 1 minute between exercises. Experimental Group-I received 3 sessions per week of routine physical therapy with equal weight bearing sit-to-stand exercise for 45-60 minutes. In one session, routine physiotherapy mentioned above was given with equal weight bearing STS exercise (20 rep). In STS exercise, affected foot positioned alongside the unaffected foot for rising with chair arm-rest assistance.

Data was analyzed using SPSS version 22.0 statistical package. The assessment was done before treatment, at 4th week and after 8th week of intervention using berg balance scale. The numerical data like age, total BBS (berg balance scale) was presented in the form of Mean±SD. Categorical data like gender was presented in the form of frequency and percentage. Independent sample t-test was used for comparison of control and experimental Group. The significance of results was determined by *p*-value (*p*<0.05). The significance of the total berg balance score was determined for the of lower extremity which was the sum of all the 14 items.

RESULTS

Control Group consist of 12 stroke patients, out of which had 5(41.7%) hemorrhagic while 7(58.3%) had ischemic stroke with age Mean±SD of 49.42±6.29 years. In Experimental Group, there were 2(16.7%) hemorrhagic while 10(83.3%) stroke patients and the minimum age was 43 years and maximum age was 60 years with age Mean±SD of 50.83±5.73. In control Group, 8(66.7%) patients suffered with right cerebral hemisphere and had left sided hemi-paralysis while 4(33.3%) suffered from left cerebral hemisphere and had right sided hemi-paralysis. In experimental Group, 6(50%) patients suffered with right cerebral hemisphere and had left sided hemi-paralysis while 6(50%) suffered from left cerebral hemisphere and had right sided hemi-paralysis. (Table-I) According to *p*-value=0.001

for factor significant improvement was seen in berg balance scale total score from baseline till 2nd follow up. While no significant difference was observed in follow-up 1 as $p=0.10$. (Table-II)

Table-I: Descriptive statistics of General Characteristics and the total Berg Balance scale (BBS) in both Groups (n=24)

Parameters	Control Group	Experimental Group
Gender		
Male	5(41.7%)	10(83.3%)
Female	7(58.3%)	2(16.7%)
Type of Stroke		
Ischemic	7(58.3%)	10(83.3%)
Hemorrhagic	5(41.7%)	2(16.7%)
Affected side		
Left	8(66.7%)	6(50%)
Right	4(33.3%)	6(50%)
Age (years)		
Min	41	43
Max	60	60

Table-II: Group comparison of Berg Balance Score (n=24)

Control Group (n=12)	Experimental Group (n=12)	t(df)	p-value
Berg balance score (Baseline assessment)			
11±6.94	10.67±5.399	0.13(22)	0.89
Berg balance score (Follow-up 1)			
14.58±8.317	19±4.712	1.69(22)	0.10
Berg balance score (Follow-up 2)			
19.50±7.052	30.08±6.417	3.84(22)	0.001

The Mean Scores for Berg Balance Scales for two Groups are close at baseline and at 1st and 2nd follow-up the mean score for berg Balance Scale of Experimental Group is higher than mean score of Routine Physical therapy. (Figure)

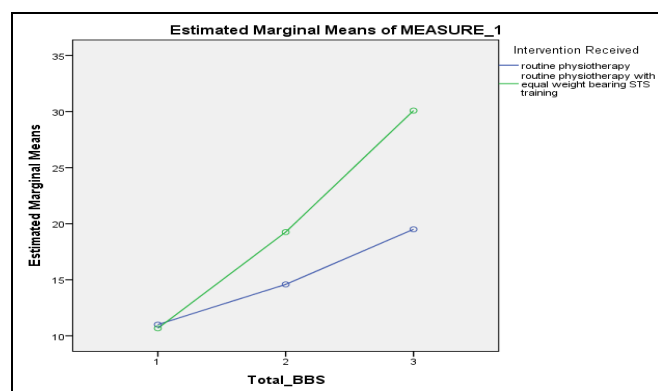


Figure: the above figure shows the trend for Total Berg Balance scale from base line till last follow up time period.

DISCUSSION

The results of this study showed that equal weight bearing sit to stand exercise program with

routine physiotherapy is more effective than only routine physiotherapy in improving balance and functional independence in stroke patients. The p -value for balance outcome between Group was (<0.05) showing a significant difference in both treatments Groups.

Contrary to the results of this study, a systematic review and meta-analysis¹¹ done in 2019 showed no evidence favoring the efficacy of sit to stand exercise for improving balance in neurological disorders. While a moderate quality evidence, favoring the effectiveness of sit to stand exercise program for improving performance was also reported. Another study¹² concluded that a modified sit-to-stand training is more effective in improving balance in hemiplegic patients than the equal weight bearing sit to stand exercises. The results of this study are opposite to the present study which showed that equal weight bearing sit to stand has efficacy in improving balance in stroke patients. Contradictory to the findings of our study Park,¹³ found that the repetitive sit-to-stand training is significant in asymmetrical Group showed increases in static and dynamic balance in comparison to the spontaneous Group. Conflicting results obtained in another study.¹⁴ That in sit to stand training asymmetrical foot position resulted in improved balance and mobility in patients with chronic stroke as compared to the symmetrical foot position.

Similar to the findings of current study, another study,¹⁵ done in 2009 determined the efficacy of sit-to-stand training in stroke patients. The data showed significant improvements in affected hip extensor strength and anterior direction control in the experimental Group as compared with the control Group. Therefore, this article concluded that sit-to-stand training in addition to routine physiotherapy is effective on hip extensor muscles strength and dynamic balance in stroke patients. Similar to the results of the present study, another study,¹⁶ that, Intensive task-specific training is recommended as an important component of rehabilitation early following severe traumatic brain injury.

A RCT,¹⁷ compared the effects of repeated sit-to-stands exercise at home compared with low-intensity progressive resistance training. In older adults with mobility limitations, repeated sit-to-stands home exercise improved Berg Balance Scale score while low-intensity progressive resistance training did not. Hemiplegic patients place more weight on the non-paretic leg and have diminished capacity to move weight

inside their base of help without Balance loss and had an expanded occurrence of falls.¹⁸ More studies need to be done to evaluate its efficacy in large sample of patients with different stroke stages; acute, sub-acute and chronic. The long terms effects of training should be evaluated. The effect of sit to stand exercises in comparison with other techniques should also be found. Blindness may be done to avoid biasness.

CONCLUSION

This study concluded that equal weight bearing sit to stand exercise program with routine physiotherapy was more effective to improve balance in sub-acute stroke patients as compared to the only routine physiotherapy.

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Conflict of Interest: None.

Author's Contribution

Following authors have made substantial contributions to the manuscript as under:

MHI & FK: Study design, drafting the manuscript, data interpretation, critical review, approval of the final version to be published.

AA & SS: Data acquisition, data analysis, approval of the final version to be published.

ZI: Critical review, concept, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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